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SCIENCE INSTRUCTION IN ELEMENTARY SCHOOLS: SOME PEDAGOGICAL AND CURRICULA IMPLICATIONS.

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ABSTRACT

This paper reports a 6 months survey of pedagogical practices in science instruction in elementary schools. It explores instructional strategies and practices within the learning-teaching situation. Data were gathered by classroom observation and interview. All the 42 public primary schools in Calabar Municipality and all the science subject head teachers in the schools were used for the study. Essentially data collected from observation covers time allocation to science among other pedagogical variables. Data collected were compared to process teaching approach in science Instruction. Results reveal a textbook driven curriculum, didactic teaching, memorization and regurgitation of science theories, facts and concepts. The paper proffers recommends a reorientation and reorganization of elementary science curricula.

INTRODUCTION

The National Policy on Science and Technology (1986) recognizes Science and Technology (S & T) as critical instruments that can promote the development of any nation. Many nations spend significant amount of their resources in research and development in order to advance their sciences and technology. Essentially, the level of development of a nation is often , measured by the level of S & T advancement. For most countries investment in S & T have yielded good returns as it has open windows to nature's secrets, gingered industrialization and raised the standard of living. In health, agriculture, environment etc, S & T has created significant impact on their advancement.

To lay the foundation for S & T development, emphasis is usually laid on a functional school science curricula. The euphoria and subsequent reorganization of America science curricula following Russia's Sputnik I underscore the role of school curricula in laying the structure and foundation for the advancement of S & T. Many nations also had to reorganize their school curricula at post independence era with greater emphasis on science and technology.

After more than two decades of Science Curricula in the three tiers of education, Nigeria is yet to show-case any significant advancement and/or contributions in S & T. Many questions easily come to mind. Why is Nigeria not developed in the area of science and technology ? How far is the school playing the role expected of it in advancing science and Technology ? To get the framework of answers to these and other allied questions, the researcher considered it necessary to find out how science instruction is carried out and to what extent pedagogical practices influence the advancement of science in elementary schools.

THEORETICAL CONSIDERATIONS

Many researchers (Eliason & Jenkins, 1977; Aleyideino 1989; 1991; Bany 1992; and Kuhn, 1993) have commended on science instruction in schools. Eliason and Jenkins (19977) noted that children have a natural

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curiosity for things around them and this curiosity, likened to that of a scientist is associated with children's nature which is evident from their exploring, experimenting, touching, tasting and manipulating with every thing they come in contact with. How far are children given opportunity for these activities especially within the classroom instruction in science ?

From a constructivist view of learning, children come to formal science learning with existing explanatory ideas of scientific phenomena (Gunstone, 1991) acquired from within their environment which the teacher must probe into in order to elicit relevant entry behaviour. How often do teachers probe pupils conceptual positions prior to and during science instruction ?

Kuhn (1993) observed that science instruction should pursue two major goals: understanding strategies necessary to solve problems and constructing new understanding. Rutherford and Ahlgren (1990) described an ideal science curricula as conceptually driven rather than detail driven. How far does this apply to science instructional practices in schools ?

Reif and Larkin (1991) have also noted that central to learning and doing science are observing and interacting with real world objects and events; making predictions on how they work, constructing and writing explanation. In addition students are taught how to ask relevant questions and seek for answers from diverse sources.

Aleyideino (1989) has this to say about science:

> Unfortunately, many people ... mistaken the results of science for science itself.
> Science is a way of thinking. Science is NOT a list of discoveries; ... Science is NOT a scheme for naming plants and animals.

Obviously, developmental thought processes rather than the acquisition of scientific facts is emphasized here. Banu (1992) observed that the goal of science education at school level appeared to be that of making students acquire the knowledge of science in order to pass external examinations. Thus teachers taught the knowledge of science in a dogmatic fashion.

There is a general consensus among researchers on the nature of science instruction. Science is seen as an activity whose processes rather than the products should be emphasized within teaching – learning situation. This survey reveal current practices within our school in as much as science teaching is concerned.

OBJECTIVE OF THE STUDY

Science is a process rather than a product. How is this reflected in science instruction is the crux of this paper. Basically the paper seeks to find out how science is taught in primary school and discuss the implication to teaching and learning of science as well as the development of science and technology.

RESEARCH QUESTIONS:

The following questions will be the focus of this study:

(i) Is science taught as other subjects or differently?
(ii) What time is allocated to science teaching?
(iii) Why do teachers teach science the way they do?

METHODOLOGY

Subject:

All the 42 public primary school in Calabar Municipality in Cross River State were used for the study. Forty-two science subject head teachers participated in the study.

Pre-Classroom Observation:

Each of the 42 schools involved in the study was visited. Time table, curriculum modules and syllabus were collected for study to elicit possible information on science topics, pupil's activities, instructional materials and other variables indicated for science instruction. This is

done to facilitate observation of science instruction. Pupils last term examination results were also collected.

Classroom Observation:

Each grade level in each school was visited twice. In all 304 visits was made each involving 30 minutes (per visit per class) and this lasted for 6 months. Like a participant observer the researcher was closely involved in attending science classes.

Post-Classroom Observation:

Forty two science head teachers were interviewed as a follow-up to post lessons observation.

RESULTS

Pre-Classroom Observation:

Science is taught thrice in a week and each period lasts for 30 minutes. Science constitute 7.5% of the total period per week. The table below shows distribution of period for subjects.

Curriculum Modules/Syllabus

Existing modules were not available in all the classroom. The scheme of work in operation is similar in content to those used in the eighties.

Classroom Observation

The classroom visits revealed a near-standard procedure used by teachers. All the teachers adopt similar methods. Entry behaviour aimed only at seeking pupils attention. In introduction the teacher gets at the topic immediately followed by explanation/definition of concepts, phenomena and notes are written on the chalkboard for pupils to copy.

A typical example of a science class recorded by the researcher goes thus:

... the teacher got into the class. The pupils stood up and greeted. As entry behaviour the teacher asked them to 'sit, stand,' 'sit, stand' repeatedly or they are asked to recite a poem. Once attention has been solicited, the topic for the lesson is introduced, defined and explained. Questions come in the form of do you understand ? to which the pupils almost always chorused 'Yes'. Notes are written on the chalkboard and pupils asked to copy into their notebooks.

Demonstration, experimentation and use of instructional materials were rearly used. Basically no laboratory was used because they were not available and where available are not equipped.

Teaching therefore was essentially didatical with the teacher depending absolutely on what the science textbooks offered. Group activities were completely absent.

INTERVIEW

The teachers were unanimous in their response to what they conceive science to be, how science should be taught and why they teach the way they do. They see science as any other subject taught in the school although they agreed that science is an important subject.

Many are also of the view that science should be taught through demonstration and experimentation but they 'lack the skills to do so and in addition, the materials are not available to carry out the needed experiment. One teacher has this to say:

Science is like any other subject but not as important as English and Mathematics. I teach science as I will teach social studies because I follow what the science textbook and workbook present. I am also teaching science the way I am taught at the college and during my NCE. Scienceinstructors who taught me also relied on textbooks and most of the time they just give lectures. Laboratory experiment received very little attention and in some semesters during my NCE, Science was learned through handouts.

Hear another one:

Since I have been in this school for the past 10 years, we have taught science through the textbooks and our pupils have always done well in external examination. How do I perform an experiment to these little children when even college students or NCE students are not taught ? Where are even the facilities

to do that ?

GENERAL DISCUSSION AND IMPLICATION

This study provides evidence that traditional approaches to science teaching which are reflected in science textbooks and workbooks are used by the teachers as strick guides rather than as resources and thus present science theoretically without practical demonstration of most science phenomena. There was no significant differences among all the school studied in this text-driven curriculum and theoretical teaching.

Traditional approaches to science teaching remains primarily didactic and dominated by lecture, textbook readings and memorization of scientific concepts and facts. This approach has been consistently shown to be ineffective in engaging student interest or developing conceptual understanding of the subject matter (Tobias, 1990, Driver 1983, Hewson & Hewson, 1988; Bell 1981).

It does appears that many teachers are severely deficient in their understanding of the subject matter they teach because they have learnt their science through traditional methods (Smith, 1987). Teachers who do not hold strong content understanding tend to teach didactically relying on textbooks, and lecture notes to transmit information to students. To break this cycle of 'didactic teaching- learning-teaching' require new emphasis on teacher education production and assignment of teaching responsibility. When they enter classroom, teachers bring with them knowledge and beliefs about the content to be learned and the process of learning. These preconceptions form a filter through which teachers carry out their own teaching essentially as a result of years of didactic discourse and having pedagogical conception that is represented by the teaching of science as textbook or lecture dominated. Smith (1987) and Tilgner (1990) have noted that teachers are comfortable with these because they are familiar methods that requires less of content knowledge.

The way the nature of knowledge is presented during the years of schooling is likely to affect students understanding of it, and, consequently, how they relate. Science is presented as a body of knowledge, proven facts, and absolute truths; and this tends to encourage memorization of facts. Elementary school teachers take only a few science content course during their in-service programmes (NCE or B.Ed) and then they are expected to teach a broad range of science content to children. Many teachers therefore enter the methodology classes

Table 1: Summary of periods for subjects per week.

Subject	No. of periods//Week	% age of total period/Week
Agriculture Science	4	10
English	5	12.4
Local Language	4	10
Mathematics	5	12.4
Science	3	7.5
Home Economics	3	7.5
Health/Physical Education	5	12.4
Religion	2	5
Social Studies	2	5
Art	1	2.5
Music	1	2.5
Labour	4	10

deficient in their conceptual understanding of the science content they are learning to teach (Stofflett & Stoddart, 1991). They therefore hold very naive conceptions about scientific phenomena almost similar to the children they teach (Summers & Palacio, 1990; Smith, 1987). Yet teachers personal understanding of subject matter content exerts a powerful influence on their instructional practices (Shulman, 1986; Grossman, 1989).

If our schools are to make any remarkable progress in science, the role expectation for those who teach science must change from dispensers of scientific theories and facts to developers of process approach to problem solving (Edmondson & Novak, 1993). This call to question the entire school curricula. Why for instance, is the checkout practice whereby trained science teachers teach science across the various levels (primary 1-6)? Not adopted.?

Why allow a social studies NCE teacher to teach science, English, Mathematics, Art, Music and so on. It's time we adapt the subject specialization teaching where those who have training in Mathematics teach Mathematics and nothing else. This has an implication on school curricula. First a teacher in training must first specialized or take more courses in the subject are before methodology classes. This will enable the teacher to grasp the content matter before going into the methods of teaching the contents. Perhaps only trained science teachers who view science and will teach science as a way of thinking, not a static body of knowledge in science, it must be explicitly taught as a process. Reif and Larkin (1991) recommended that students in science classes should be taught how to ask relevant questions, make predictions, acquire information from many sources, Weigh alternatives and reach defensible explanation. As Booth (1978) also noted, children must be given opportunities to discover, invent and get caught up with scientific and technological processes. To do this Gauld (1982) advocated for scientific attitudes – behaviour that demonstrate open-mindness, objectivity, critical questioning and rational mind. Unless teachers themselves are equipped with a scientific attitude, this cannot be achieved.

As textbooks remain the only readily available resources and teachers guide, scientist and teachers should be encouraged to participate in the writing, edition and prescription of text. In other words, the publication of science textbooks should not be left in the hands of publishers alone. In addition, textbooks should be accompanied by a host of resources materials e.g video tapes, overhead transparencies, laboratory manuals, posters, study guides, test item banks etc. These can guide the teachers in the selection of topics, organisation of lessons, assignment of activities, (Glynn & Muth, 1994), as well as improving the overall teaching-learning outcome.

Time allocated to science should be increased from 3 to 5 or even more. Science is so close to nature and the children's environment that it should be taught more than once in a day. As a subject that requires process approach and spontaneous in nature, it must be continuous. Science activities occur everyday in the child's environment and the teacher must use these occurrences to project science and its processes

CONCLUSION

Whereas, science is a critical factor in development and prosperity of nations, it is the most neglected subject in our public primary schools. Pupils rarely if ever have science experiences as science is taught as definitions and explanation of factual knowledge. There seems to be some 'pedagogical compliance' as the same culture pervades the entire schools. Teachers are so entangled with the curriculum modules written some twenty years ago and are afraid of innovations and deviation from the modules. This however was traced to the supervisors from the Ministries and Local Education authority who would insist on perpetuation of these old paradigm of *'this is the way it is done'*. So many teachers with new visions do not have the opportunities of personalizing and changing the *status quo* .

It's time we bring our scientist and science

educators together to plan and reorganize our entire science curriculum and science instruction to save it from textbook-driven, chalk-talk methods, memorization of facts, and move towards inquiry-oriented methods that facilitate scientific literacy and conceptual understanding.

REFERENCES

Aleyideino, S., 1989. Science and the background of Nigerian Children. Journal of Science Teachers Association of Nigeria 26(1): 100-104

Banu, D. P., 1992. Trends in the goals and objectives of Science Education. Journal of Science Teachers Association of Nigeria 27(2): 25-29

Bell, B. F., 1981. When is an animal, not an animal ? Journal of Biological Education 15:213 – 218

Booth, N., 1978. Science in the Middle years. Education 6(2): 37 –41:

Driver, R., The pupil as Scientist ? Milton Keyaes: Open University Press.

Edmondson, K. M. and Novak, J. D., 1993. The interplay of Scientific, epistemological views, learning strategies and attitudes of College students. Journal of Research in Science 61: 239 – 264

Federal Ministry of Science and Technology, 1986. National Policy on Science & Technology. Ibadan: NIHORT.

Gauld, C. F., 1982. The Scientific attitude and Science Education. A critical reappraisal. Science Education 66(1):109-121.

Glynn, S. M. and Muth, K. D., 1994. Reading and Writing to learn science achieving scientific literacy. Journal of Research in Science Teaching 31(9): 1057–1073.

Grossman, P. L., 1989. Learning to teach without teacher education. Teachers College Record, 91:191-208

Hewson, P. W. and Hewson, M., 1988. An appropriate conception of Teaching Science: A view from studies of science Learning. Science Education 72: 597 – 614.

Kuhn, D., 1993, Science as argument: Implication for teaching and learning scientific thinking. Science Education 77:319-337.

Loucks-Horsley, S., Kapitan, R., Carlson, M. D., Kuerbis, P. J., Clark, R. C., Mclle, G. M., Sachse, T. and Walton, E., 1990. Elementary School for the 90s. Andover : The National Centre for improving Science Education.

Reif, R. and Larkin, J. H., 1991. Cognition in Scientific and everyday domains. Comparism and learning implications. Journal of Research in Science Teaching, 28: 733-760.

Rutherford, F. J. and Ahlgren, A. I., 1990. Science for all Americans. New York: Oxford University Press.